United States Patent

Cielaszyk

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[54] **ONE-PIECE ROLLER-IMPULSE MEMBER FOR TIMEPIECE ESCAPEMENT**

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[73] Assignee: **General Time Corporation, Phoenix, Ariz.**

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[52] **U.S. Cl.** **58/122**

[51] **Int. Cl.** **G04b 15/08**

[58] **Field of Search** ..... 58/116 R, 121 R, 122, 140

[56] **References Cited**

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[57] **ABSTRACT**

A one-piece safety roller and impulse member for a timepiece escapement control is disclosed. The combination element is a low coefficient of friction engineering plastic and serves the control purpose of two separate elements heretofore used in the art of timepiece lever escapements to which this invention pertains.

2 Claims, 5 Drawing Figures

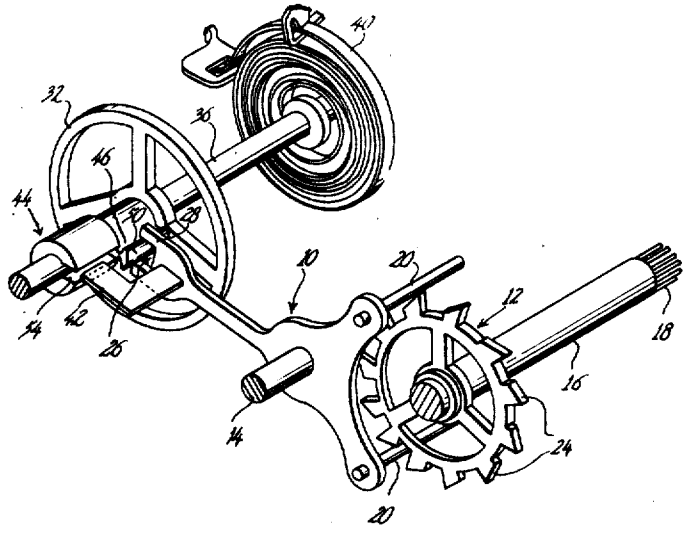


FIG. 1

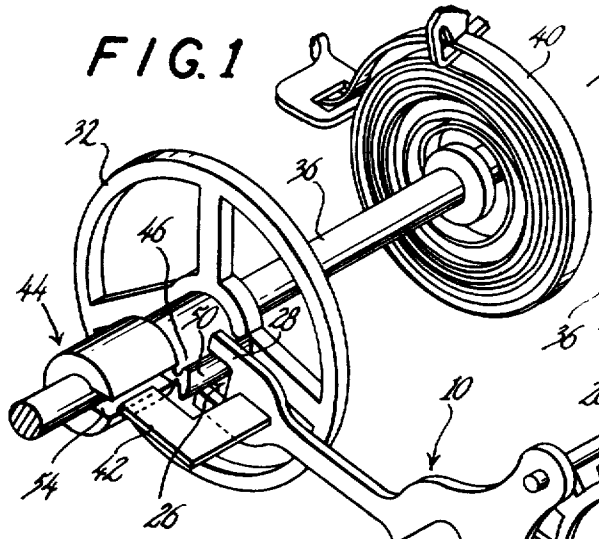
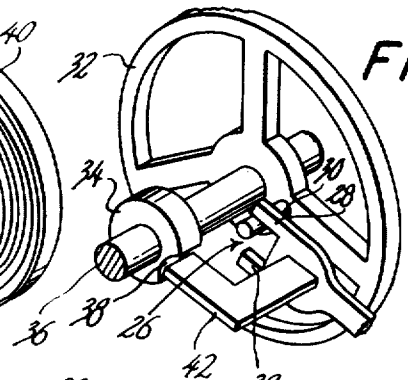


FIG. 2
PRIOR ART



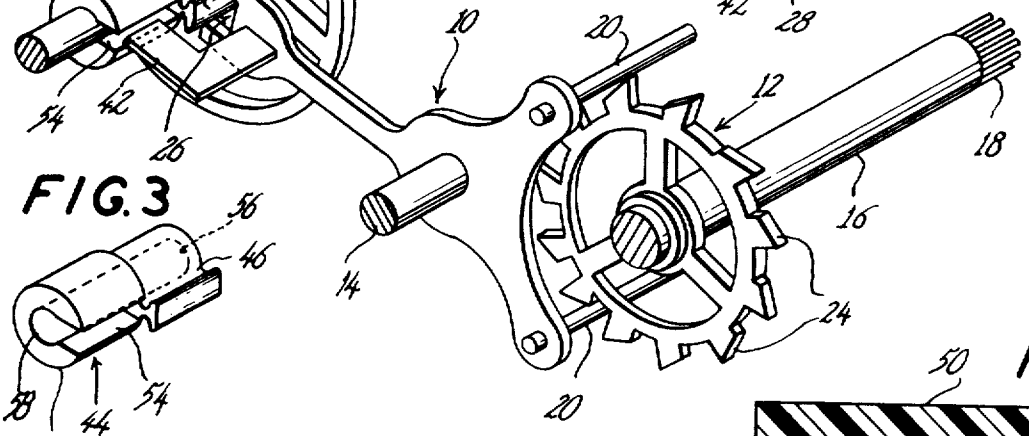


FIG. 3

FIG. 5

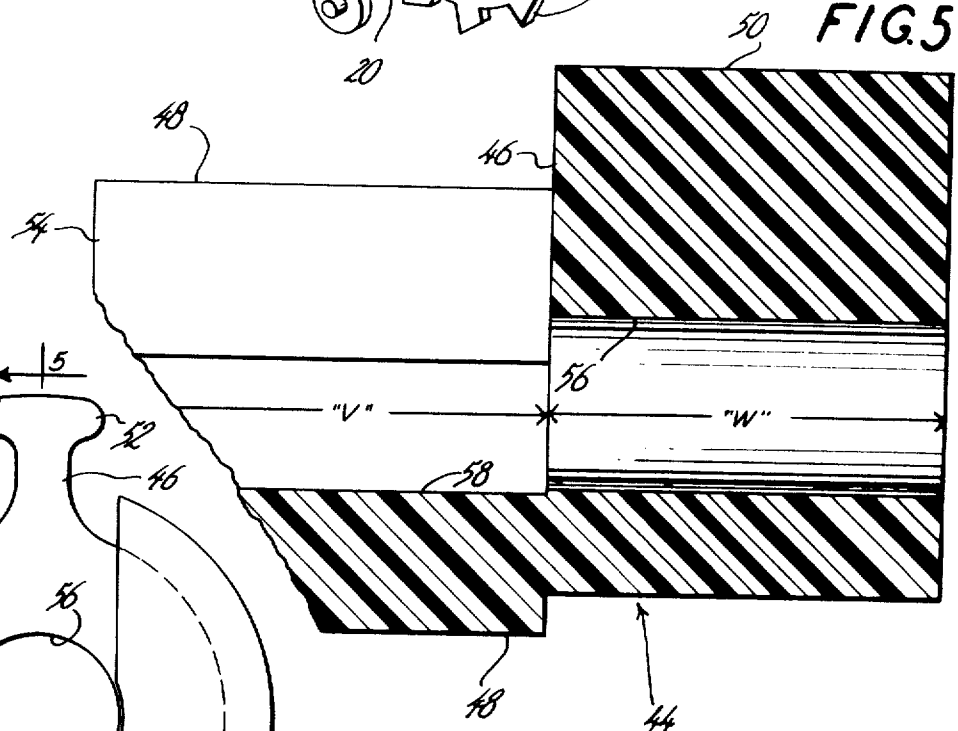
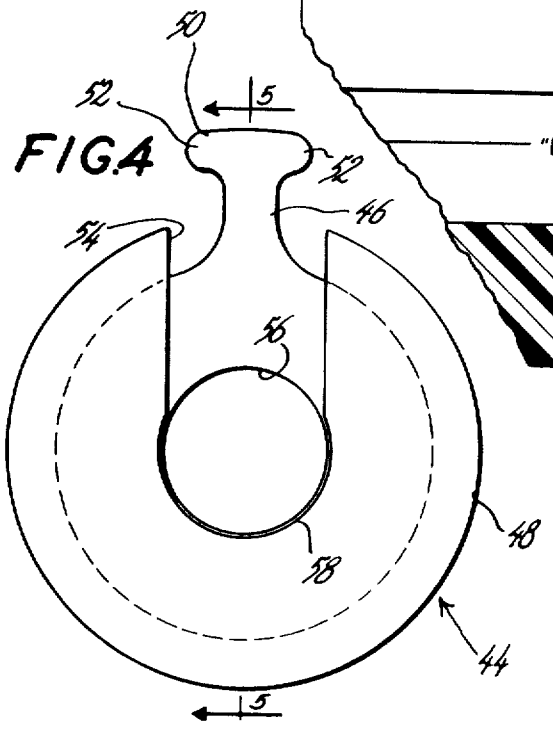


FIG. 4



ONE-PIECE ROLLER-IMPULSE MEMBER FOR TIMEPIECE ESCAPEMENT

BACKGROUND OF THE INVENTION

Lever escapements are predominately used in springwound clocks and watches. Common use is a toothed escape wheel connected through a gear train. The escape wheel is powered from the well known mainspring or other power source. An escapement lever pivoted about a point between its ends has at one end a pair of pallet pins and at its other end a fork. The pins are separated by a distance between the teeth of the escape wheel according to a well known formula. A balance wheel, biased by the usual hairspring, is arranged for oscillation on a balance staff.

As shown in the prior art (FIG. 2) an impulse pin of hardened steel (or jewel) is fixed to the balance wheel. A safety roller of brass or the like is fixed on the balance wheel shaft and is laterally separated from the impulse pin. The safety roller cooperates with the well known guard pin which is fixed in the escapement lever adjacent the forked end thereof. The indented or crescent portion of the safety roller allows the guard pin to pass freely when the escapement lever is unlocked, during oscillations of the balance wheel.

More specifically, the escape wheel, driven by the mainspring of the timepiece through its gear train, forces the escapement lever to pivot. Consequently, the forked end of the escapement lever acts on the impulse pin, causing the balance wheel to rotate and increase tension of the hairspring. The tensioned hairspring then causes rotation of the balance wheel in the opposite direction. The escapement lever being held in its banking position due to the draft action between the pallet and escape wheel tooth, is positioned for entry of the impulse pin as the balance rotates. Due to the inertia of the balance wheel and the energy stored in the hairspring, the impulse pin enters the fork slot of the lever during its return, rotating said lever and unlocking the lever pallet from the escape wheel tooth. When the unlocking action is completed, the escape wheel, driven by the mainspring and gear train, rotates, forcing the lever pallet outward thereby again pivoting the lever. The opposite side of the fork slot on the pivoting lever then strikes the opposite side of the impulse pin, causing the balance wheel to rotate and increase tension of the hairspring in the opposite direction. The opposite lever pallet at this time, locks another escape wheel tooth and the lever is now positioned for entry of the impulse pin in the opposite direction. As long as power is transmitted to the escape wheel, the sequence described continues to cycle.

The type escapement described is the commonly known detached lever escapement, where the balance is free of the influence of the escapement and power from the gear train, except during unlocking and impulse. The lever is positioned for repeated entry and re-entry of the impulse member into the forked end of the escapement lever. If the timepiece and consequently the movement is subjected to an external shock, the escapement lever may be jolted away from its banking position at a crucial time during balance wheel oscillation, when the impulse member is out of the fork slot of the lever, and cause lock-up of the movement. To insure entry of the impulse pin into the lever fork, the motion of the lever away from the banking during shocks is limited by the interaction of the guard pin and safety roll. The lock remains between pallet and escape wheel and is commonly referred to as guard pin safety lock.

In light of the above, the principal object of the present invention is to provide an improved timepiece escapement mechanism that features an extremely efficient escapement control element in the form of a combination safety roll and impulse member that is simple in construction, very inexpensive to manufacture, is easy to install, requires no adjustment, is very durable in use and has very low coefficient of friction. In prior and current escapements of the type disclosed herein, the impulse pin must necessarily be lubricated to reduce the coefficient of friction during unlocking. However, lubrication

is detrimental during impulse because of the adhesion between the fork members and impulse pin. In keeping with the principal object of this invention, the one piece safety roll and impulse member is made of a low coefficient of friction plastic, requiring no lubrication, while smoothly effecting the unlocking sequence of the escapement cycle thereby eliminating the problem of adhesion.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an enlarged schematic perspective view of the escapement mechanism of a timepiece showing the novel combination safety-roller — impulse member of the present invention;

FIG. 2 is similar to FIG. 1 but shows the safety roller and impulse pin arrangement so well known in the prior art;

FIG. 3 is a perspective view of the combination safety roller - impulse member of FIG. 1;

FIG. 4 is greatly enlarged front elevational view thereof; and

FIG. 5 is a sectional view taken along lines 5 — 5 of FIG. 4.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to FIG. 1 of the drawing, there is shown an escapement comprising an escape lever **10** and an escape wheel **12** which form the basic portion of a clock or watch escapement. The escape lever is mounted on an escape lever shaft **14** which is journaled in the base plates (not shown) of the movement. The escape wheel **12** is mounted on an escape wheel shaft **16**, one end of which is also journaled in the base plates. The toothed end of shaft **16** is driven by the main spring of the movement by means of the gear train, the operation and characteristics of which are very well known and therefor not disclosed herein. The escape lever **10** carries a pair of pallet pins **20** which alternately engage the teeth **24** of the escape wheel **12** and effect the impulsing and locking operations that result in a unidirectional rotation of the escape wheel **12**. If the escape wheel **12** is not periodically locked, the main spring will rotate the gear train at full speed until the main spring is completely unwound. The escape wheel is prevented from such free rotation by the action of the escape lever **10** which includes a fork-like portion **26** at one end thereof.

In the prior art, shown in FIG. 2, the opening formed by the times of the fork, is adapted to fit over an impulse pin **30**, which is usually of hardened steel or a jewel and is fixed adjacent the hub of a balance wheel **32** in a well-known manner. Roller **34**, commonly known as the safety roller and customarily of brass, is secured fast to a balance wheel staff **36** by pinning or the like. An indented crescent **38** of the safety roller allows the roller to pass under the urge of a hairspring **40** when the escape lever **10** is unlocked. The movement of the lever by the impulse pin is made at the fork; the impulse pin enters the fork opening and unlocking and impulse are effected. As one tooth slides off the impulse plane of one of the pallet pins, another tooth is stopped by the other pallet pin. During the stopping of the escape wheel, the balance wheel **32** continues to rotate; impulse pin **30** is then completely free of the fork-like portion **26**. During the circular motion of the balance, the hairspring **40** has been "wound up" until it has stopped the balance and reversed its motion. The impulse pin **30** then returns to the fork opening, strikes a fork tine and pivots lever **10** whereupon the escape wheel **12** is unlocked. The sliding of a tooth **24** on the other pallet so begins again and the cycle continues. Thus the motion of the balance wheel **32** is maintained by the locking and unlocking action to generate impulses. Guard pin **42** is fixed at the forked end of escape lever **10** and aligns with crescent **38** during the unlocking and impulse functions of the escape lever. During the remainder of the oscillatory excursion of the balance wheel the guard pin **42** serves to prevent unlocking of the escapement lever **10** and thereby guards against malfunction of the escapement mechanism.

According to the present invention, a simple one-piece roller and impulse member is generally designated **44** and is provided with an impulse portion **46** and a safety roller portion **48**. The composite unit **44** is preferably of a durable plastic such as DELRIN, for one example, and is formed as shown in the drawings. The impulse portion **46** is provided with a fork engaging extension **50** having rounded edges **52** which contribute to the smooth operation of the escapement by rolling in and out of contact with the tine **28**. Due to the character of the plastic material, application of lubrication between parts is unnecessary.

To insure that the all-important concentricity of the safety roller portion **48** is preserved, and also to facilitate assembly, the safety roller portion is provided with a complete opening **54** or poising slot for accomodating the guard end of guard pin **42** in distinction to the notch **38** of the prior art FIG. **2**. The poising slot **54** is aligned with the fork-engaging extension **50**, as best seen in FIG. **4**.

It is important to note that a bore **56** in impulse portion **46** is of lesser diameter than the semi-circular base **58** of the opening **54** in safety roller portion **48**. Reference is made to the zone designated "W" which is of lesser diameter than the zone designated "V" in FIG. **5**.

Accordingly, in assembling the composite one piece roller and impulse member, the bore **56** is entered on the balance staff and the composite unit is positioned by force-fitting, completely independent of the balance wheel. Assembly is greatly facilitated by obviating independent and critical alignment of impulse pin and safety roller which was heretofore the practice.

From the foregoing description it may be readily ascertained that the invention may be readily and reliably reproduced and assembled at a very high production rate and with attendant low manufacturing costs.

What is claimed is:

1. In a timepiece having a driven escape wheel with evenly spaced teeth about the periphery thereof, a two-ended escape lever pivoted between its ends, the escape lever having pallets at one end engaging the teeth of the escape wheel and a fork at its other end, a guard pin also at the other end of the escape lever adjacent the fork, a balance staff impulsed in a first direction by the fork of the escape lever through the driven teeth of the escape wheel, a hairspring connected to the balance staff to drive same in a direction opposite the impulsed first direction following an impulse imparted by the fork of the escape lever, the improvement comprising

a composite impulse member and safety roller formed of durable plastic and force-fitted on the balance staff in operative relation to the fork and guard pin of the escape lever to timingly control the drive of the escape wheel, said impulse member having an impulse portion integral therewith and said safety roller having a slotted portion therein, the impulse and slotted portions being formed in the same axial plane to operatively cooperate with the fork and guard pin, respectively, of the escape lever, and means integral with said impulse member and safety roller for maintaining the concentricity of the safety roller during the force-fitting of the composite impulse member and safety roller on the balance staff.

2. The composite impulse member and safety roller of claim **4** wherein said means for maintaining the concentricity of said safety roller comprises, the impulse member having bore therethrough and the safety roller slotted portion having a substantially semi-circular base portion on the same axis of the bore as the impulse member, the bore in the impulse member being of smaller diameter than the semi-circular bore in the safety roller, whereby the concentricity of the safety roller is preserved during force fitting of the composite impulse member and safety roller on the balance staff.

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